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ABSTRACT

The purpose of this study was to examine the relationship between the class scheduling of a pharmacology course for L.P.N. students at the College of Lake County, in Grayslake, Illinois, and the final course grade. It was hypothesized that subjects will learn pharmacology concepts more effectively when the course content is concentrated within a shorter time span. Subjects were 30 students enrolled in spring 1973 who were assigned to a one hour/week class for 16 weeks and 24 in spring 1974 scheduled three hours/week for 6 weeks. The mean age of the 1973 group was 23, range 18-45, with an A.C.T. composite score mean of 15. The mean age of the 1974 group was 25, range 18-43, with an A.C.T. composite score mean of 16.7. The final grade for both groups was based on a final written examination and unit quizzes. These and the text were the same for both groups. A parametric test, the t-test, was used plus an opinionnaire consisting of eight items and using a scale scoring response. Of the 1973 subjects, 57 percent received a grade of F for the course, while 16 percent failed in 1974. The t-test indicated a mean difference of 10.258 estimated standard deviation for population of 10.579, standard error of difference of 2.897, T-Ratio of 3.541, 52 degrees of freedom and -6.924 difference of critical mean. The probability level was set at the 0.1 level for a one-tailed test. The obtained T-Value exceeded the Critical Values of a t-table value. Based on the t-test and subjects scale scoring responses, the recommendations are: (1) change the text; (2) consider educational background of subjects when selecting text; (3) consider reading level of text; (4) revise lectures to correlate with new text; (5) schedule future classes for three hours/week for 6 weeks block; and (6) continue to evaluate student achievement. (Author)

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A STRATEGY TO IMPROVE GRADES IN A PHARMACOLOGY COURSE FOR L.P.N. STUDENTS

BY

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ABSTRACT

TITLE: " A STRATEGY TO IMPROVE GRADES IN A PHARMACOLOGY COURSE FOR L.P.N. STUDENTS"

The purpose of this study was to examine the relationship between the class scheduling of a Pharmacology course for L.P.N. students at the College of Lake County in Grayslake, IL and the final course grade. It was hypothesized that S_s will learn Pharmacology concepts more effectively when the course content is concentrated within a shorter time span. S_s were 30 students enrolled in spring 1973 who were assigned to a 1 hr/wk class for 16 weeks and 24 in spring 1974 scheduled 3 hrs/wk for 6 weeks. The mean age of 1973 group was 23, range 18-45 with an A.C.T. composite score mean of 15. The mean age of 1974 group was 25, range 18-43 with an A.C.T. composite score mean of 16.7. The final grade for both groups was based upon a final written examination and unit quizzes. These and the text were the same for both groups. A parametric test, the t-test, was used plus an opinionaire consisting of 8 items using a scale scoring response. 57% of the 1973 S_s received a grade of F for the course while 16% failed in 1974. The t-test indicated a mean difference of 10.258 estimated standard deviation for population of 10.579, standard error of difference of 2.897, T-Ratio of 3.541, 52 degrees of freedom and -6.924 difference of critical mean. The probability level was set at the 0.1 level for a one-tailed test. The obtained T-Value exceeded the Critical Values of t table value. The differences were proven to be real and not chance. Based on the t-test and S_s scale scoring responses the recommendations are 1) change the text; 2) consider educational background of S_s when selecting text; 3) consider reading level of text; 4) revise lectures to correlate with new text; 5) schedule future classes for 3 hrs/wk for 6 wk block; and 6) continue to evaluate student achievement.

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INTRODUCTION

Context of the Problem

In the fall of 1971, a new faculty member was employed by the college to replace a nursing instructor who moved to another state. Many problems arose when the students discovered this was her first teaching experience. During her second year of teaching, 17 out of 30 students failed one of her courses, Pharmacology. Since this did not occur in the other courses she taught, this writer as the Coordinator of the program, felt that a study of the reading level of the textbook, an item analysis of the test questions, and an exploration of other possible factors should be conducted to determine and remedy the cause. This module practicum seemed to provide an opportunity to examine the problem without the instructor being offended.

Statement of the Problem

The purpose of this study was to examine the relationship between the class scheduling of a specific course and the final course grade for students currently enrolled in the L.P.N. program who completed the Pharmacology course on March 8. The course was scheduled for three hours per week over a six week period. A comparison was made of the grades of the last graduated class who completed the program in August of 1973 and had attended one hour of Pharmacology per week over a sixteen week period.

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BACKGROUND AND SIGNIFICANCE

Review of the Literature

Learning is a change in insights, behavior, perception, or motivation which is influenced by teaching. Every one who teaches is governed by a theory of learning. Teachers who understand educational psychology tend to have more effectual results in their classes. A theory of learning reflects an assumption about the basic nature of the learner. The relationship between a student's learning process and the using of learned material in life situations is referred to as transfer.(1)

The teacher must plan which learnings (responses) the student needs to develop and then provides the necessary stimuli. This is all that is necessary for learning according the associationists' theory of motivation. A Gestalt-Field Theorist regards motivation as a psychological situation characterized by a person's desire to do something. Spence (1959) indicates that, in complex learning, changes in performance are dependent upon incentive motivational factors. He believes that research in learning activities will produce the knowledge needed to aid the teacher in the effective direction of student learning.(2)

There are approximately twelve known learning theories known to educators which provide many facts atout learning. There is also apparent agreement that experimental procedures should be attempted to validate the facts. In general, facts

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and principles of learning are accepted when they have been validly demonstrated to be reasonably consistent and applicable to practical situations. Berthold (1951) listed 160 items pertaining to administrative provisions for individual differences among which flexible courses, provisions for individual differences among students, differentiated curricula, etc. were points noted under the need for serious curriculum adjustment.(3)

Ebbinghaus (1885) was the first to conduct a study of a series of syllables to prove that the time needed to learn material increased more rapidly than its length. Robinson and Heron (1922) and Robinson and Darrow (1924) studied the length of material and deferred retention and proved that, with identical learning criteria, longer material was retained better than shorter. Sand (1939) verified a hypothesis which stated that the longer a series, the more likely the subject is to encounter elements with which he is familiar and which, consequently, he can memorize more easily.(4)

In the decade of the sixties, much research activity was centered around the characteristics of short-term forgetting. The effects of rate of presentation on short-term memory appears confusing and even contradictory in the literature available. Findings in other studies seem somewhat divergent. On the whole, data seems to support the generalization that rate of presentation does not affect

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short-term memory. Memory is of obvious significance for learning. The amount of forgetting that takes place between a presentation and a test or even between one lecture and another are important factors to the learner. By varying the presentation rate in short-term memory experiments one may obtain data concerning the nature of forgetting from short-term memory. A fast rate of presentation should not facilitate short-term memory. Glanzer and Cunitz (1966) conducted experiments concerning rate of presentation proving that short-term memory is not a function of rate of presentation. Conrad and Hille (1958) proved in three experiments that better performance is reported with fast rates of presentation than with slow rates. The efficiency of learning can be further manipulated through the interspersing of test trials between presentations. This was first noted in an experiment by Izawa (1966).(5)

Skinner (1953) states that "education is the establishing of behavior which will be of advantage to the individual and to others at some future time". Pressey (1959) and his associates claimed that learning feeds on success. Failure can discourage students. Stephens (1956) surveyed a number of relevant studies and found that at the college level, tests given once or twice a term were just as effective for learning course content as frequent tests. Adult learners are capable of developing long-range

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motivation for a short-range learning task which requires massed practice over an extended period of time. Forgetting is an active and not a passive process. Pressey (1959) concluded that at the end of a course, students remember about three-fourths of the facts covered. One year later, they remember one-half and two years following the conclusion of the course, about one-fourth the facts are remembered. Material that is meaningful is generally not forgotten. Stevens (1956) reported that studies agree that overlearning contributes to retention and the additional practice after initial mastery is valuable in learning. Retention seems to be higher when study periods are spaced methodically over the course of an entire semester and long-range results from cramming are usually poor.

An efficiency expert, Franklyn W. Taylor, in the late nineteenth century assumed that any task can be done better if one develops the attitude that new approaches and methods will improve present performance. Skinner (1956) illustrated this attitude in his development of the Skinner box. To control the educational setting to the point where all the students earn A grades is not the ultimate goal of educators as there are other values in education than good grades. John Dewey (1938) argued that education is "life" itself and not just a preparation for life and he believed that "life" may rebel at efforts directed to improve it. However, most psychologists will agree that there should be an effort to increase the efficiency of what we are now trying to do. (6)

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Student failure is a serious matter. The cause for failure must be determined. Often there is a combination of causes in any given case. A serious study of the failures of one group might inhibit the failure of future students. (7)

Statement of the Hypothesis

H_1: It was hypothesized that S_s will learn Pharmacology concepts more effectively when the course content is concentrated within a shorter time span.

Rationale for the Hypothesis

Offering the pharmacology course three hours a week for six weeks concurrently with Medical-Surgical Nursing and a Sociology or Psychology elective rather than one hour per week for the full semester along with one hour of Diet Therapy and one hour of Gerontology in addition to the Medical-Surgical Nursing and elective courses, permits the student to concentrate more fully on the subject matter and provides greater continuity between lectures.

Operational Definition

Pharmacology achievement being measured by written unit quizzes and a final examination indicates this is a Type C operational definition.

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Significance of the Study

The spring term is the second semester for students enrolled in a one year practical nursing certificate program which consists of two full 15 credit hour semesters and one 8 credit hour session in the summer. The curriculum is integrated and the 38 credit hours attained are non-transferrable with the exception of the solitary elective of either sociology or psychology. During the second semester, the student enrolls in NUR 115 - Practical Nursing II comprised of

Medical & Surgical Nursing...4 hours
Gerontology.....1 hour
Diet Therapy.....1 hour
Pharmacology.....1 hour
Elective (Soc or Psy).....3 hours

These class hours comprise 10 hours lecture per week which is correlated with clinical lab experience for 15 hours per week in local hospitals and nursing homes. The clinical lab experiences are equated to 5 hours and the student receives a Pass/Fail grade for each four week rotation assigned. The course which has in the past caused the most frustration and concern, as well as the lowest grades, is Pharmacology. When 17 of the 30 students enrolled in the spring semester of 1973 received a final grade of F in the course, it was evident that the causative factor had to be determined. In addition to the course being rescheduled, the reading level of the texttook was determined. Scheduling of the course for future classes is contingent upon the results of this study.

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PROCEDURES

Subjects

S_s were thirty students enrolled in the College of Lake County L.P.N. Program during the spring of 1973 and twenty-four students enrolled in the spring of 1974. The Pharmacology course is a program requirement. The 1973 S_s consisted of twenty-eight females and two males with a class mean age of 23, range of 18 to 45 years. The 1974 S_s consisted of twenty-four females with a mean age of 25, range 18-43 years.

Tasks

The final grade for the course was based upon a final examination and unit quizzes and was the same for both groups of S_s. The same textbook was used by both groups and there were no written or oral assignments for either group.

Variables

The variable that was manipulated or changed to cause a change in the failure rate of students in the L.P.N. Program Pharmacology course was the class hour schedule, the independent variable.

Learning cannot be directly measured and is, therefore, the intervening variable.

The achievement criteria which comprised the final grade, the dependent variable, consisted of a final examination plus

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unit quizzes which were measured to determine the effect of the independent variable.

Statistical Design

A parametric test, the t-test, was used to compare the mean of the final course grades for each group of S_s. This determined the probability that the difference between the means is a real difference rather than a chance difference. This test was chosen because the dependent variable is an interval scale and the independent variable is nominal.

An opinionaire form (see Appendix I) consisting of eight items and using the scale scoring response procedure was completed by the S_s of the study. The purpose of this survey was to ascertain positive and negative aspects of the course as viewed by the S_s.

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RESULTS

The concept of correlation is understood by the use of a scattergram, the product-moment coefficient of correlation (r) which provides a statistical summary of the scattergram. In a single statistic the relationship between two measures may be depicted. A third perspective is the index of common variance.(8) A coefficient of correlation is of greater meaning mathematically than educationally or psychologically, however, the square of the coefficient does have psychological meaning.

Both groups in this study were assigned sixteen hours of scheduled class time during the spring semester by the same pharmacology instructor. Students enrolled in both groups were solely practical nursing students who had completed fifteen hours of theory and clinical lab experience as a group. All the students were currently enrolled in the second semester of the one year certificate program and shared the same experiences in all classes which are taken together. The same textbook was used and the same unit quizzes and final examination were given to both groups. The classroom physical facility was similar for both classes.

The age range for the Class of 1973 was 18 to 45 years, with a mean of 23 for twenty-eight females and two males. The Class of 1974 consisted of twenty-four females with a

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range in age of 18 to 43 years and a mean of 25.

The American College Test (A.C.T.) is one of the criteria for admission to the program. The minimum composite score established as the cut-off point for both classes was 12. The A.C.T. composite score mean for the Class of 1973 was 15 and the Class of 1974 was 16.7.

This writer believes tne correlations between the mean age and the mean A.C.T. composite score with the final course grade would not be significant and enters these statistics merely for interest and background information.

Table 1. Frequency Distribution of Final Grades

Score	f	Score	f	Score	f
95	1	80	2	66	1
94	2	79	1	65	2
91	2	78	2	64	2
90	1	77	1	63	2
89	2	75	1	61	1
87	1	73	3	60	1
86	2	72	1	59	1
85	2	70	4	57	1
84	2	69	1	56	1
83	1	68	1	54	1
81	2	67	4	53	2
					N = 54

In the above table it is noted that N = 54 and 21 of these received a final grade of 69-53. In the grading scale used by the program a grade of F is given for numerical scores falling between 69-0. Seventeen of the 21 were in the 1973 group and four in the 1974 group.

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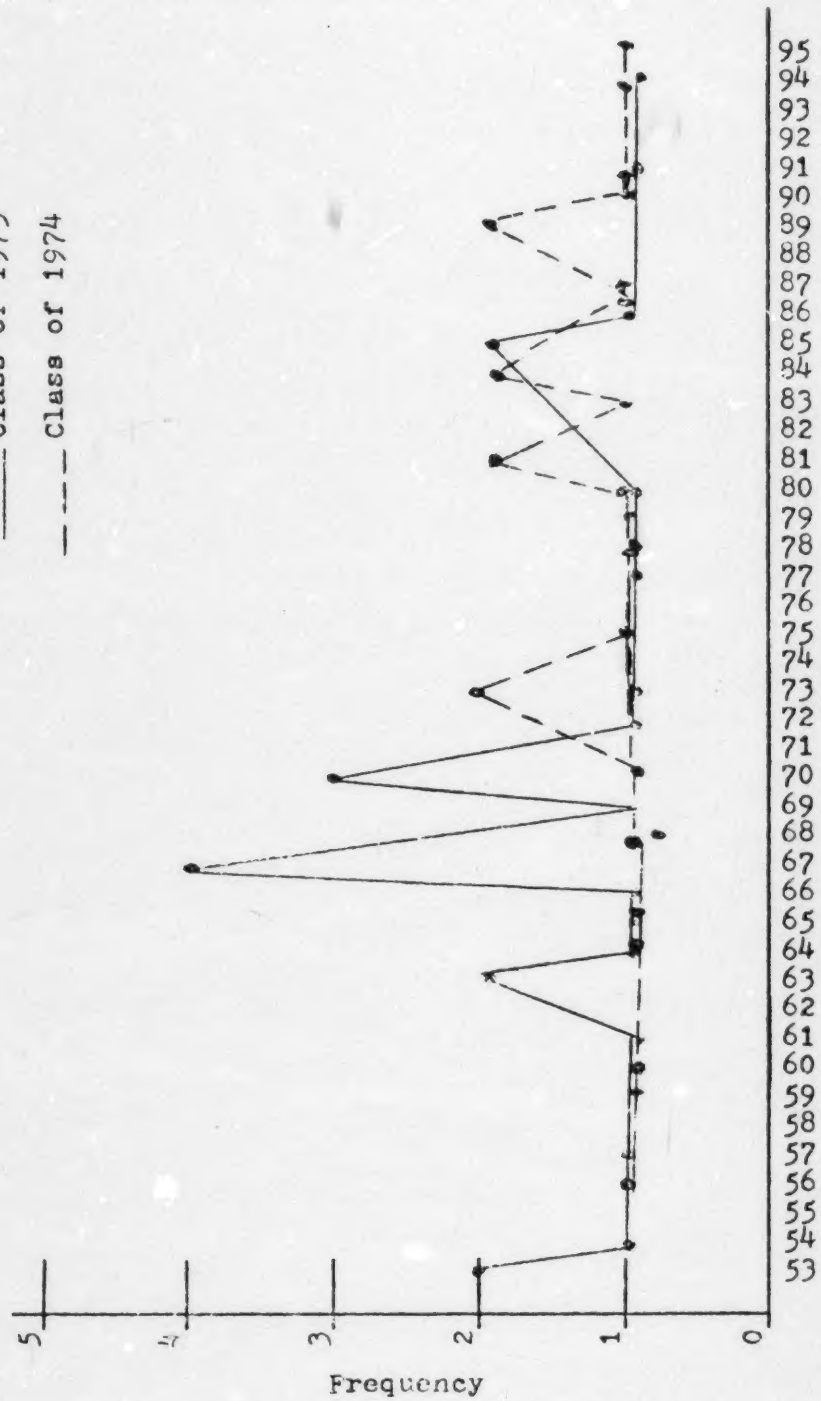

Figure 1. Frequency polygons of two sets of final grades.

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In Figure 1 one can readily observe the higher grades achieved by the Class of 1974 represented by the broken green line. The highest grade of 95 was attained by a student in this group while the three lowest grades of 53 (2) and 54 were in the Class of 1973 group represented by the solid red line. The greater number of plotted points below 70, the minimum passing grade, in red indicate the higher failure rate in the Class of 1973.

Table 2. Letter Grade Frequencies

Grading Scale	f (1973)	f (1974)	N
A = 100-93	1	2	3
B = 92-85	3	6	9
C = 84-77	4	8	12
D = 76-70	5	4	9
F = 69-0	17	4	21

N = 54

In the above table one can note that the number of A, B, and C letter grades for the Class of 1974 exactly doubles the number in the Class of 1973. On the other hand, the Class of 1974 received fewer grades of D and F than did the other group of students. Twenty-two of the 1973 group received a grade less than C compared to eight in 1974.

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For the calculation of group variances please see Appendix II and III.

T -test shows a statistical comparison between the two means to determine the probability that the difference between the means is a real difference rather than a chance difference.[9] The following formula was used in calculating the statistics in Table 3.

Step 1. $$\frac{(N_1-1)\, s_1^2 + (N_2-1)\, s_2^2}{N_1+N_2-2}$$

Step 2. $$\frac{N_1+N_2}{N_1 N_2}$$

Step 3. Step 1 x Step 2

Step 4. $$\sqrt{\text{Step 3}}$$

Step 5. $$\overline{X_1} - \overline{X_2}$$

Step 6. $$t = \frac{\text{Step 5}}{\text{Step 4}} \qquad df = N_1 + N_2 - 2$$

Table 3. T Test of Mean Differences

	Class of 1973	Class of 1974
Mean	69.5333	79.792
Standard Deviation	10.739	9.916
Group Size	30.	24.

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Small group results (N(1)+N(2) 60):

Mean Difference	= 10.258
Estimated Standard Deviation for Population	= 10.579
Standard Error of Difference	= 2.897
T Ratio	= 3.541
Degrees of Freedom	= 52.
Difference of the Critical Mean	= -6.924

The probability level (confidence level) was set as 99% (the 0.1 level) indicating a probability of only 1 out of 100 chances that the difference was a result of chance. (-10.259) This was .01 Level of significance for a one-tailed test with the 52 df = 2.390 using the closest figure found on the Critical Value Table (60). The obtained T-Value 3.541 exceeds the Critical Values of t table value of 2.390, therefore, the null hypothesis that the means are equal can be rejected at this p level. The differences have been proven to be real and not chance because the difference between the two means is 2.897. Therefore, the 1974 Group is better than the 1973 Group in regard to the Pharmacology grades.

When evaluating written material submitted to Delmar Publishers, the editors use consistent criteria. One of these consists of checking the manuscript periodically for reading level. The following procedure is followed:

a. select 150 words in sequence
b. count the number of one-syllable words
c. apply the formula:

21- (number of one syllable words ÷ 10)
= grade level

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The practical nursing students are considered freshmen college level or grade 13. Three sections of the book were selected at random by this writer and the Delmar formula (10) applied. The following results indicate the textbook is written at the desired grade level.

Page 123 (drug Cephalothin - Keflin)

grade level = 13.2

Page 285 Respiratory Center

grade level = 13.5

Page 577 Fluorouracil (FU)

grade level = 12.5

Average of three examples = 13.6

Table 4. Scale Scoring Responses

ITEM #	SA	A	U	D	SD
1	10	18	2	4	2
2	3	18	7	6	2
3	11	17	7	1	0
4	0	2	26	4	4
5	6	12	11	4	3
6	5	3	5	7	16
7	14	9	4	3	6
8	6	14	9	7	0

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An interpretation of the responses indicates that 28% strongly agree that the textbook was difficult to readand comprehend while 50% agree, 5.5% were undecided, 11% disagreed, and 5.5% strongly disagreed. Comments of several respondees states that the book was too much in-depth, referred to former courses in Microbiology and Chemistry which the practical nursing student in general has not had, included too many chemical formulas, and would be a good reference book. According to responses 8% strongly agreed and 50% agreed that the instructor correlated the lectures with the text while 19.5% were undecided, 17% disagreed, and 5.5% strongly disagreed. When asked if the textbook should be changed 30.5% strongly agreed, 47% agreed and 19.5% were undecided with 3% in disagreement and 0% in strong disagreement. The Class of 1974 has not taken the state licensing examination as yet and could not answer item #4. Of the twelve 1973 S_s responding 17% agreed, 17% were undecided, 33% disagreed and 33% strongly disagreed that course content was covered in the licensing exam. No one strongly agreed. Several comments on this item inferred that only three questions on Pharmacology were included and no mathematical calculation of dosages was required. In regard to the course being necessary to safely administer medications in clinical practice, 17.5% strongly agreed, 33% agreed, 30.5% were undecided, 11% disagreed and 8% strongly disagreed.

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Pertaining to the class scheduling 14.5% strongly agree, 8% agreed, 14.5% were undecided, 19% disagreed and 44% strongly disagreed that the course should be given one hour per week over the full semester while 39% strongly agreed, 25% agreed, 11% were undecided, 8% disagreed and 17% strongly disagreed that the course be concentrated for three hours per week in a six week block. 17% strongly agreed, 39% agreed, 25% were undecided, 19% disagreed while 0% strongly disagreed that the course schedule had an effect upon their grade. The Class of 1974 had a 100% response and the Class of 1973 had a 40% response.

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RECOMMENDATIONS

Since the Pharmacology course is a program requirement, it is essential that all efforts be directed toward a minimum of student failures.

Based upon the statistical results, the following recommendations are offered:

1. The pharmacology instructor should make a serious study of all available textbooks and recommend a textbook change for the Class of 1975 to the Curriculum Commission. It should be kept in mind that
   a) Although the grade level of the written text is at 13, freshman level, there are differences in student ability at grade 13. For example, a beginning practical nursing student, a registered professional nursing student, and a nursing baccalaureate student are all at the college freshman level. Therefore, specific content must be studied in addition to the reading level.
   b) Former educational experiences and science plus mathematics backgrounds must be considered in the selection of the text.
2. The instructor correlated the lectures with the text.

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However, if the text was considered too difficult for the students to comprehend a possibility exists that the lecture content was also too difficult for the student to grasp. The instructor should revise lectures to correlate with the new text.

3. Although few questions are asked on the state licensing examination pertaining to pharmacology, the faculty must remember that

   a) Faculty of state approved nursing programs are not supposed to teach <u>to</u> the licensing examination.

   b) Faculty must prepare the practical nurse to function safely in the administration of the duties assigned to her as a graduate. Since the administration of medications is a function of the L.P.N., it is essential that the course continue to be offered in-depth.

4. If the faculty is in agreement concerning the necessity for pharmacology knowledge and the students are not learning the material at a passing level, the teaching method should be analyzed.

5. Had the test grades not improved with the Class of 1974 vs. 1973, the recommendation of a test item analysis would be a recommendation.

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6. The results indicate that the rescheduling of the course did have a positive effect on the grades of the students and, therefore, the recommendation is made that all future classes be concentrated for three hours per week for a six week block instead of one hour per week for a 16-18 week semester.
7. Continue to evaluate student achievement.

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Appendix I BEST COPY AVAILABLE

March 20, 1974

Dear Class of 1973:

One year ago you were enrolled in NUR 115 - Practical Nursing II and many of you were expressing concerns over the Pharmacology course. The large number of failures have been of constant concern to the faculty.

This year the course was scheduled for three hours per week over a six week period. A comparative study of the final grades received by your class and the class of 1974 is presently underway.

In order to understand your feelings, would you spend five minutes of your time completing the enclosed opinionaire and return it in the self-addressed stamped envelope no later than April 1. It is imperative that this target date be met as the statistics will be calculated on April 5.

Thanking you in advance, I remain

Sincerely,

(Mrs.) Gloria M. Grippando
Coordinator, LPN Program

Enclosures

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PHARMACOLOGY OPINIONAIRE

This scale has been prepared to enable you to indicate your feelings about the Pharmacology course you completed as part of NUR 115 - Practical Nursing II. Please circle the letter(s) on the left indicating how you feel about each statement. (SA strongly agree, A agree, U undecided, D disagree, SD strongly disagree)

SA A U D SD 1. The textbook was difficult to read and comprehend.

SA A U D SD 2. The content of the textbook correlated with the lectures.

SA A U D SD 3. The textbook should be changed.

SA A U D SD 4. The state licensing examination contained material covered in the course. (For Class of 1973 only.)

SA A U D SD 5. The amount of material covered was necessary to safely administer medications in clinical practice.

SA A U D SD 6. The course should be scheduled one hour per week for a full semester.

SA A U D SD 7. The course should be concentrated for six weeks of three hours per week.

SA A U D SD 8. The class scheduling of the course had an effect on the final grade you received.

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Appendix II

Variance - Class of 1973 Pharmacology Grades

Subject	Score (x)	$(X-\bar{X})=x$	x^2
1	94	+24.47	+598.78
2	72	+ 2.47	+ 6.10
3	61	- 8.53	- 72.76
4	63	- 6.53	- 42.64
5	77	+ 7.47	+ 55.80
6	64	- 5.53	- 30.58
7	86	+16.47	+271.26
8	66	- 3.53	- 12.46
9	53	-16.53	-273.24
10	70	- 0.47	- 0.22
11	54	-15.53	-241.18
12	85	+15.47	+239.32
13	57	-12.53	-157.00
14	91	+21.47	+460.96
15	78	+ 8.47	+ 71.74
16	67	- 2.53	- 6.40
17	67	- 2.53	- 6.40
18	85	+15.47	+239.32
19	67	- 2.53	- 6.40
20	69	- 0.53	- 0.28

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Subject	Score (x)	$(X-\bar{X})=x$	x^2
21	65	- 4.53	- 20.52
22	59	-10.53	-110.88
23	80	+10.47	+109.62
24	70	+0.47	+ 0.22
25	67	- 2.53	- 6.40
26	60	- 9.53	- 90.82
27	73	+ 3.47	+ 12.04
28	63	- 6.53	- 42.64
29	53	-16.53	-273.24
30	70	+ 0.47	+ 0.22
N= 30	ΣX= 2086	x= 0	Σx^2= +753.42

$$s^2 = \frac{\Sigma(X-\bar{X})^2}{N} = \frac{\Sigma x^2}{N} = +25.11$$

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Appendix III

Variance - Class of 1974 Pharmacology Grades

Subject	Score (x)	$(X-\bar{X})=x$	x^2
1	91	+11.21	+125.66
2	75	- 4.79	- 22.94
3	89	+ 9.21	+ 84.82
4	68	-11.79	-139.00
5	89	+ 9.21	+ 84.82
6	87	+ 7.21	+ 51.98
7	84	+ 4.21	+ 17.72
8	78	- 1.79	- 3.20
9	73	- 6.79	- 46.10
10	79	- 0.79	- 0.165
11	70	- 9.79	- 95.84
12	83	+ 3.21	+ 10.30
13	64	-15.79	-249.32
14	95	+15.21	+231.34
15	65	-14.79	-203.95
16	90	+10.21	+104.24
17	80	+ 0.21	+ 0.04
18	56	-23.79	-565.96
19	81	+ 1.21	+ 1.46
20	86	+ 6.21	+ 38.56
21	81	+ 1.21	+ 1.46
22	94	+14.21	+201.92
23	73	- 6.79	- 46.10
24	84	+ 4.21	+ 17.72

BEST COPY AVAILABLE

Subject	Score (x)	$(X-\bar{X})=x$	x^2
N= 24	ΣX= 1915	x= 0	Σx^2= -354.65

$$s^2 = \frac{\Sigma(X-\bar{X})^2}{N} = \frac{\Sigma x^2}{N} = -14.77$$

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